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Working mechanisms in positive interventions: A study using daily assessment of positive emotions

Gander, Fabian ; Proyer, René T ; Hentz, Eva ; Ruch, Willibald

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Working mechanisms in positive interventions: A study using daily assessment of positive emotions

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Abstract

One commonly suggested mechanism in positive psychology interventions (PPIs) involves the elicitation of positive emotions. We examined (1) whether PPIs increase the intensity and variety of positive emotions; (2) which positive emotions are elicited by two different PPIs; and (3) the impact of positive emotions on well-being. In a randomized, controlled one-week intervention study, we compared the “three good things” and the “three funny things” intervention with a placebo control. We assessed the positive and negative emotions reported daily during the intervention, and the well-being and depressive symptoms directly before, after, and one week after the intervention. Results showed higher intensity and variety of positive emotions elicited by the PPIs, and increases in well-being could be explained by the intensity and variety of positive emotions. The study provides a model for how the mechanisms underlying PPIs can be studied and underlines the relevance of positive emotions in PPIs.

Keywords: Positive emotions, positive psychology interventions, well-being, positive psychology; working mechanisms

Working mechanisms in positive interventions: A study using daily assessment of positive emotions.

While the effectiveness of positive psychology interventions (PPIs) for increasing well-being is well documented (e.g., Bolier et al., 2013; Sin & Lyubomirsky, 2009), little is known about the underlying mechanisms that drive this effect. Numerous "candidates" as to the potential working mechanisms have been suggested. Among these, positive emotions are frequently mentioned and are also included in Sin and Lyubomirsky's (2009) definition of PPIs: "[…] treatment methods or intentional activities that aim to cultivate positive feelings, behaviors, or cognitions" (p. 468). Their importance is also highlighted in theoretical approaches. For example, the positive-activity model (Lyubomirsky & Layous, 2013) lists positive emotions as relevant mediators in PPIs. The *hedonic adaptation prevention* (HAP) model suggests that sustainable changes in well-being are achieved through positive events and positive emotions following an initial positive change (Sheldon & Lyubomirsky, 2012). Further, the model predicts that sustainable increases in well-being are more likely when positive emotions (and events) have more variety. However, studies that directly examine the working mechanisms in PPIs are still rare.

Among the few notable exceptions were studies that assessed these potential working mechanism in the context of PPIs, such as intrinsic goal pursuit (Heekerens & Heinitz, 2019) or daily experiences of positive emotions (Fredrickson et al., 2008). Other research has varied the instructions of existing PPIs in order to manipulate the effects of different mechanisms (Gander et al., 2018; Wellenzohn et al., 2016). These studies support the notion that positive emotions, cognitive processes, and attentional shifts are involved. Nonetheless, it is still unclear (1) whether both the intensity and variety of positive emotions (as suggested by the HAP-model) increase following PPIs; (2) whether different PPIs elicit different distinct emotions; and (3) whether the intensity and variety of positive emotions are predictive of the changes in well-being.

The present study

We aimed to examine the role of emotions in two previously validated PPIs; namely, *three good things* (3GT: writing down three things that had gone well and describing the experiences; Seligman et al., 2005) and *three funny things* (3FT: writing down three funny things and describing the experiences; Gander et al., 2013), in comparison with a placebo control condition (PCC: writing down an early memory; Seligman et al., 2005). We assessed well-being and depressive symptoms, daily experiences of different discrete positive and negative emotions, and analyzed the use of emotive words in participants' daily writing assignments (on good or funny things, and early memories).

We expected that both PPIs would increase well-being, the variety and intensity of reported positive emotions, and ameliorate depressive symptoms; additionally, that the participants in the intervention conditions would use positive-emotion words more frequently (and negative-emotion words less frequently), and that this would correspond to the positive and negative emotions experienced. Further, we hypothesized that the changes in well-being and depressive symptoms could be explained by the variety and intensity of positive and negative emotions. Finally, in an exploratory approach, we examined whether the PPIs differed in the profile of elicited discrete positive emotions.

Method

Participants

A total of 349 adults initially registered for participation. Of these, 20 participants had to be excluded because they did not fulfill the inclusion criteria (see below). A total of 329 participants were randomized (see Figure 1). The final sample that was eligible for participation and completed the assessments consisted of 181 participants (84% females) aged 19 to 85 (M = 40.27, SD = 15.47), of mainly German (63.0%), Swiss (29.3%), or Austrian (5.0%) origin.

Insert Figure 1 about here

Instruments

The *Authentic Happiness Inventory* (AHI, Seligman et al., 2005; German version: Proyer et al., 2017) is a self-report instrument for the assessment of well-being consisting of 24 sets of five statements describing feelings during the past week (a sample set of statements ranges from 1 = "*I have sorrow in my life*" to 5 = "*My life is filled with joy*"). We computed a total score by summing up all items. We used the AHI since it has good psychometric properties and its sensitivity for upward changes in intervention studies (Proyer et al., 2017); $\alpha = .90$ (pretest).

The *Center for Epidemiologic Studies Depression Scale* (CES-D, Radloff, 1977; German version: Hautzinger & Bailer, 1993) is a self-report instrument for the assessment of the frequency of depressive symptoms, consisting of 20 items which are rated on a 4-point scale from 0 ("Rarely or None of the Time [Less than 1 Day]") to 3 ("Most or All of the Time [5–7 Days]"). We computed a total score by summing up all items. A sample item is "*I felt sad*"; $\alpha = .89$ (pretest).

The *Modified Differential Emotions Scale* (mDES; adapted from Cohn et al., 2009) requires participants to rate their strongest experience of ten positive emotions (i.e., amusement, awe, compassion, contentment, gratitude, hope, interest, joy, love, and pride) and ten negative emotions (i.e., anger, contempt, disgust, embarrassment, fear, guilt, sadness, shame, boredom, and stress) in the past 24 hours on a 5-point scale from 0 ("not at all") to 4 ("intensely"). We added two negative emotions (boredom and stress) based on other studies (e.g., Kok et al., 2013) to balance the number of positive and negative emotions. We computed total scores for positive and negative emotions; $\alpha = .81/.79$ (pretest).

Procedure

The ethics committee at the institution of the first author approved the study. The study was conducted online. Participants were recruited via advertisements on mailing lists and online forums, and the distribution of leaflets. The inclusion criterion for participants was being ≥ 18 years of age, and the exclusion criteria was to not concurrently be in psychotherapeutic or psychopharmacologic treatment. After registration, providing informed consent, and completing basic demographic questions, participants were randomly assigned to one of three conditions via an automated random number generator. They were unaware of the existence of the different conditions. Participants chose the starting time of the program for themselves; afterwards they received their intervention assignment. Well-being and depressive symptoms were assessed at pretest (t0), after the intervention week (t7), and one week after the intervention (t14). Additionally, participants rated their positive and negative emotions (mDES) at baseline (t0) and on every day of the intervention week (t1-t7). The intervention was completed every day of the intervention week (t0-t6) between 6 p.m. and 11 p.m. using an online form. The intervention activities were always conducted last, after completing the questionnaires (see Figure 2).

Insert Figure 2 about here

After the intervention week (t8) the participants were asked whether they completed the exercise. Those who completed less than 75% of the exercises and the daily assessments were excluded from subsequent analyses. All data are available online (https://osf.io/6sbxa/?view_only=3d5e61797a2d48f2b07c86c9b0f1c5ad).

Results

Preliminary Analyses

The final sample sizes were $n = 70$ (3GT), $n = 57$ (3FT), and $n = 54$ (PCC). No differences among the conditions regarding age, gender ratio, education, the baseline scores

of well-being, depressive symptoms, or the intensity and variety of positive and negative emotions were observed.

Comparing the dropouts (n = 128; i.e., those who were lost to posttest and follow-up) and excluded participants (n = 20) with the final sample (n = 181) revealed no differences regarding age, baseline levels of well-being, depressive symptoms, or positive and negative emotions, nor differences in dropout or exclusion rates among the conditions. However, more men than women dropped out of the study (68.8% vs. 31.3%; $\chi^2[2, N = 329] = 10.51$, p = .005).

Effects on well-being and depressive symptoms

For an overall impression on whether the interventions showed effects on the outcomes, we compared both intervention conditions together with the control condition, followed by post-hoc contrasts, comparing each intervention condition separately with the control condition. We analyzed whether well-being and depressive symptoms changed during the course of the intervention (means and standard deviations are given in online supplementary Table 1) by conducting ANCOVAs, predicting the measurement time points after the intervention (i.e., the post-test or the follow-up) by the condition (0 = PCC, 1 = interventions), while controlling for the pre-test scores in well-being or depressive symptoms. Results showed no changes in well-being at the post-test ($F[1, 178] = 0.39$, p = .26, η^2_p = .00) and no effects on depressive symptoms ($F[1, 178] = 2.12$, p = .074, η^2_p = .01), but higher well-being scores in the PPIs than the PCC at the follow-up ($F[1, 178] = 2.75$, p = .049, η^2_p = .02), and no differences in depressive symptoms were observed ($F[1, 178] = 1.37$, p = .12, η^2_p = .01; all one-tailed tests). Post-hoc comparisons revealed that both PPIs yielded comparable changes in well-being (3GT: $t[121] = 1.45$, p = .074; 3FT: $t[108] = 1.45$, p = .074), while only the 3FT reduced depressive symptoms, post-test (3GT: $t[121] = -0.61$, p = .273; 3FT: $t[108]$ = -2.07, p = .020).

Effects on positive and negative emotions

Intensity

We computed intensity scores at the pre-test (t0) and during the intervention week (t1-t7) by averaging the intensity ratings of all emotions, separately for positive and negative emotions (means and standard deviations are given in online supplementary Table 1). ANCOVA results (predicting the intensity of positive or negative emotions during the intervention week by condition while controlling for the baseline) suggested a higher intensity of positive emotions in the interventions than in the PCC (F[1, 178] = 3.99, p = .024, η^2_p= .02); post-hoc comparisons revealed that this effect was comparable in both interventions (3GT: t[121] = 1.70, p = .047; 3FT: t[108] = 1.82, p = .036). No effects were observed for negative emotions (F[1, 178] = 1.56, p = .106, η^2_p = .01; all one-tailed tests).

Variety

We computed the variety scores at the pre-test (t0) and during the intervention week (t1-t7) by averaging the amount of emotions that were experienced "intensely", separately for positive and negative emotions. ANCOVA results (predicting the variety of positive or negative emotions during the intervention week by condition while controlling for the baseline) suggested a higher variety of positive emotions in the interventions than in the PCC (F[1, 178] = 9.09, p = .003, η^2_p = .05). Again, post-hoc comparisons revealed that this effect was present in both PPIs (3GT: t[121] = 2.54, p = .012; 3FT: t[108] = 2.77, p = .006). Also, no effects on the variety of negative emotions were observed (F[1, 178] = 1.67, p = .099, η^2_p = .01; all one-tailed tests).

In further analyses, we looked at distinct emotions and participants' notes during the intervention (results given as online supplementary for the sake of brevity). Results revealed that both conditions elicited more contentment, hope, and joy than the PCC, while amusement was only elicited in the 3FT. Further, both PPIs used more positive and less negative emotions words than the PCC.

Do changes in emotions predict well-being?

Finally, we examined whether the changes in well-being could be explained by positive emotions. For this purpose, we conducted a series of mediation analyses (see Figure 3), predicting the well-being at the follow-up by the condition, with positive emotions during the intervention week (residualized change scores) as a mediator, while controlling for baseline well-being (using a macro by Preacher & Hayes, 2008; 5,000 Bootstrap samples; bias corrected and accelerated confidence intervals; one-tailed tests).

Insert Figure 3 about here

Figure 3 shows that the intensity of positive emotions yielded an indirect effect on the relationship between condition and well-being. Similar results were obtained for the variety of positive emotions, or when comparing the PPIs separately with the PCC. However, when entering intensity and variety simultaneously, only intensity remained a predictor (indirect path for intensity: $b = .02$, 90% CI[.003; .049]; indirect path for variety: $b = .01$, 90% CI[-.009; .032]), because both were strongly interrelated ($r = .52$, $p < .001$).

When repeating these analyzes for distinct emotions (see online supplementary for results), in the 3FT amusement, contentment, and joy were mediators, while in the 3GT only contentment and joy were involved.

Discussion

We showed that two positive psychology interventions (PPIs) increased well-being in comparison to a placebo control condition (PCC) one-week after the intervention, while no changes immediately after the intervention week were observed. For depressive symptoms, there were no effects in the three good things condition (contrary to earlier findings; e.g., Seligman et al., 2005) and only a trend (yet nonsignificant) in the expected direction in the three funny things condition. The latter is in line with earlier findings showing that reflecting on *funny* things instead of *good* things might be more effective for reducing depressive

symptoms (Gander et al., 2013). Overall, all effects in the present study were small by conventional standards. This might be explained by small increases in well-being in the PCC; it is possible that regularly reflecting about well-being and emotions (and early childhood memories) is a PPI itself. Also, the present study used a "minimal dosage intervention"; since the main goal was studying the role of positive emotions in such interventions and not achieving a maximum effect on well-being, interventions with this goal should typically use longer intervention periods, and other delivery methods (e.g., individual or group settings; see Bolier et al., 2013).

Both PPIs increased the intensity and variety of positive emotions. Thus, PPIs might not only elicit stronger feelings of emotions, but also allow for the experience of emotions that are usually not experienced intensely. While no changes in negative emotions could be observed, concluding that negative emotions are unaffected might be premature: given the low daily prevalence of negative emotions, the used measures might not be sensitive enough to track minor changes. Also, we found a tendency towards decreasing negative emotions. Designs with more statistical power would help determine the involvement of negative emotions.

Analyses of the relative word frequency (see online supplement) mostly confirmed the questionnaire-based findings: Participants in both PPIs used more positive-emotion words than those in the PCC. Unexpectedly, positive-emotion word use was unrelated to increases in experienced positive emotions or well-being. These findings suggest that prompting participants to describe their experiences more vividly might not strengthen the intervention effects. However, the number of words participants used was predictive for the increases in positive emotions and well-being, confirming earlier findings that individual differences in *how* participants conduct an intervention is predictive of changes in well-being (Proyer et al., 2015).

Further, we found that the increases in well-being at the follow-up could be explained by both *intensity* and *variety* of positive emotions, thus supporting the hedonic adaption prevention model (Sheldon & Lyubomirsky, 2012) and earlier findings on the relevance of positive emotions (e.g., Gander et al., 2018; Wellenzohn et al., 2016). When testing both mediators simultaneously, only intensity remained a significant predictor. This might be explained by the strong relationship between the two, which is due to the fact that both scores were derived from the same responses that were coded differently.

When examining the effects on discrete emotions, results showed that while specific emotions (i.e., amusement, contentment, hope, and joy) were targeted, only amusement increased in the three funny things condition. Interestingly, all these emotions were able to explain the increases in well-being, with the exception of hope. This can be explained by the fact that changes in hope showed numerically weaker relationships to the changes in well-being ($r = .21$, $p = .005$) than the other emotions (all $r > .30$, $p < .001$). Pending further research, we carefully conclude that when aiming at increasing well-being, PPIs should be designed to allow for the experience of emotions such as amusement, contentment, or joy, while other emotions – such as hope – might be less effective.

Limitations of the study include potential variance restrictions in the emotion assessment tools, and additionally, participant dropouts (all analyses were based on complete cases, since imputation of data is often not recommended for this type of study; Sullivan et al., 2018), although no differences in dropout rates among the conditions were found. The word-use analyses were based on different writing assignments for each condition; additionally, including standardized writing assignments for the different conditions could serve as objective indicators of positive emotions and provide insight on the relevance of emotional word use for well-being. Effects on changes in well-being and depression were small and replications from higher-powered studies are warranted. Also, a comparison with a

placebo group that did not provide daily emotion ratings would be of interest to test whether rating one's emotion has an effect in itself.

Overall, this study provides a model for how the mechanisms underlying PPIs can be examined, further supports the crucial role of positive emotions in positive interventions, and provides preliminary evidence that interventions might increase both the intensity and variety of positive emotions. However, it may make sense to differentiate among the positive emotions and test which ones are particularly effective. Finally, slight variations in the instructions may result in the elicitation of a different emotional profile, therefore it is worth bearing in mind that the emotions may differ as to their contribution to increases in well-being.

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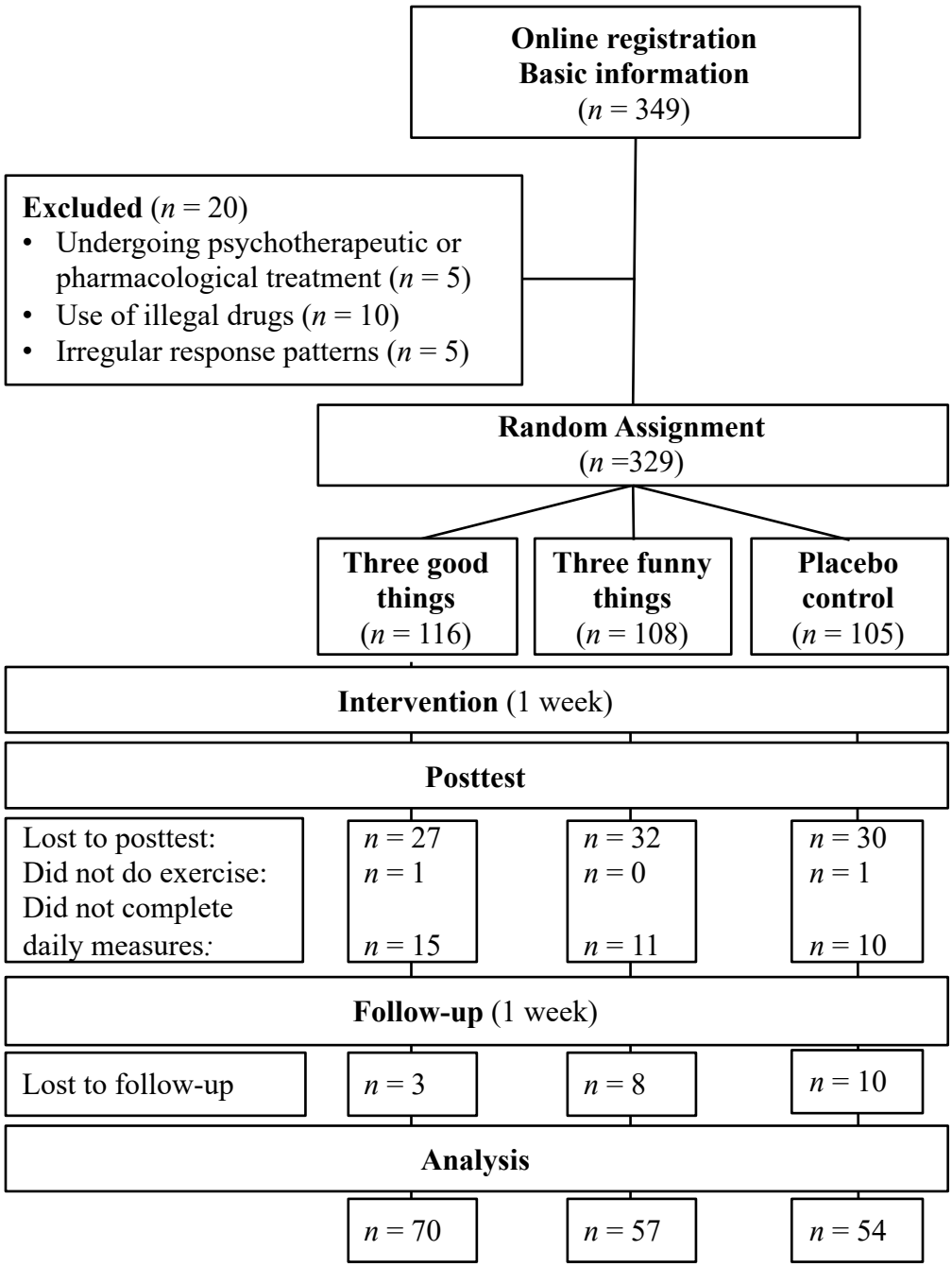

Figure 1. Flow of participants.

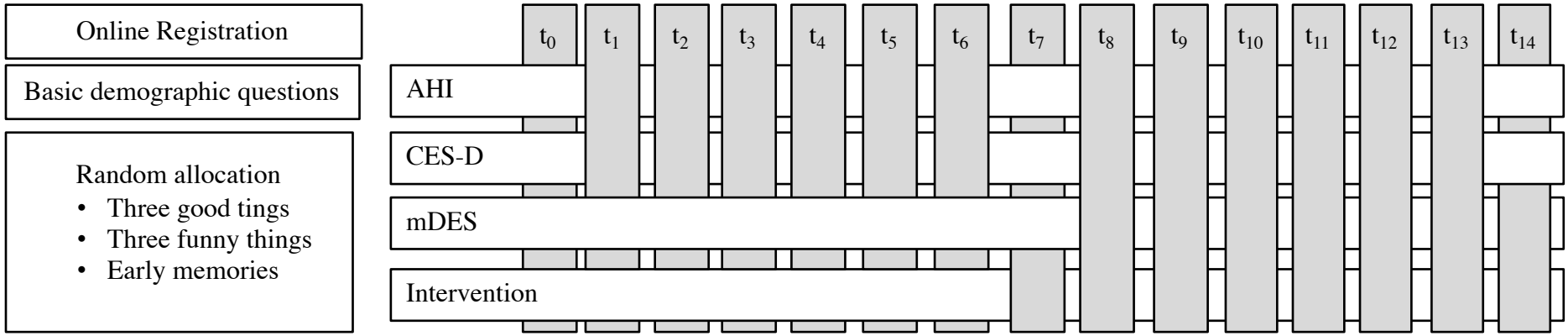

Figure 2. Data collection procedure. Horizontal bars overlapping a measurement time denote that the instrument was assessed on that time point, or the intervention was conducted on that time point.

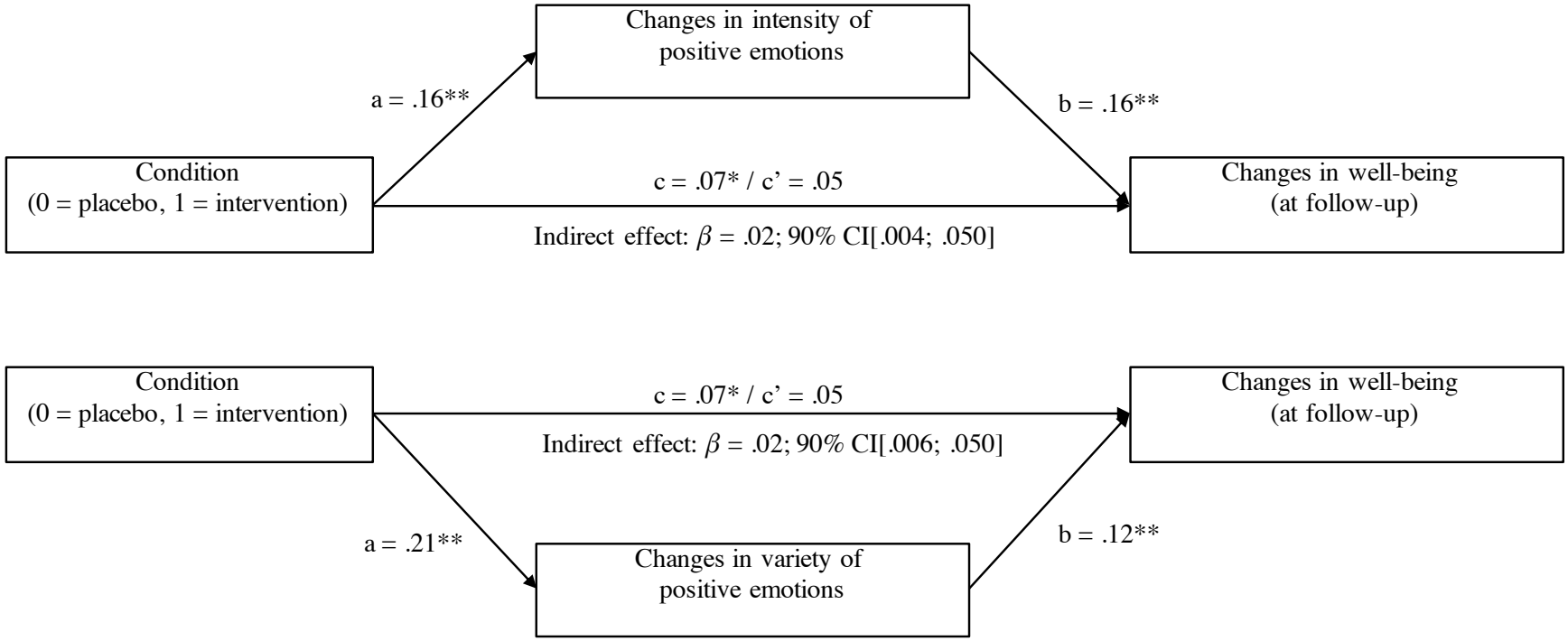

Figure 3. Results of mediation analyses when using intensity (above) or variety (below) of positive emotions as a mediator in the relationship between condition and changes in well-being.

Online Supplementary

Table 1

Means and Standard Deviations for Well-being and Depressive Symptoms.

	3 good things (n = 70)				3 funny things (n = 57)				Early memories (n = 54)			
	Well-being		Depressive Symptoms		Well-being		Depressive Symptoms		Well-being		Depressive Symptoms	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pretest	3.10	0.46	0.73	0.48	3.24	0.50	0.70	0.44	3.05	0.43	0.69	0.40
Posttest	3.14	0.49	0.67	0.44	3.32	0.51	0.57	0.37	3.10	0.46	0.68	0.40
Follow-up	3.18	0.48	0.66	0.46	3.30	0.49	0.57	0.42	3.07	0.48	0.67	0.45
	Positive Emotions		Negative Emotions		Positive Emotions		Negative Emotions		Positive Emotions		Negative Emotions	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pretest	1.96	0.63	0.68	0.57	2.01	0.70	0.62	0.46	1.93	0.58	0.65	0.60
Intervention week	2.02	0.48	0.58	0.41	2.06	0.54	0.55	0.31	1.89	0.45	0.63	0.41

Table 2

Repeated Measurement ANCOVA Results for individual Positive and Negative Emotions.

	3 good things (n = 70)						3 funny things (n = 57)						Early memories (n = 54)			
	Pretest		Intervention Week		ANCOVA		Pretest		Intervention Week		ANCOVA		Pretest		Intervention Week	
	M	*SD*	*M*	*SD*	*t*	η^2_p	*M*	*SD*	*M*	*SD*	*t*	η^2_p	*M*	*SD*	*M*	*SD*
amusement	2.06	0.92	2.24	0.59	1.03	.01	2.11	0.99	2.40	0.55	2.52*	.04	2.11	0.88	2.15	0.48
awe	1.07	1.09	1.10	0.71	-1.67†	.02	1.05	1.20	1.21	0.75	-0.52	.00	1.20	1.19	1.32	0.59
compassion	1.71	1.28	1.42	0.80	-1.00	.01	1.82	1.09	1.65	0.77	0.47	.00	1.67	1.17	1.53	0.77
contentment	2.49	0.88	2.53	0.56	2.75**	.04	2.40	0.96	2.55	0.61	3.06**	.05	2.54	0.88	2.28	0.58
gratitude	1.86	1.24	2.08	0.83	0.90	.01	2.05	1.11	2.06	0.87	0.10	.00	2.00	1.10	2.03	0.66
hope	2.29	0.98	2.26	0.62	2.65**	.04	2.28	1.08	2.15	0.75	1.53	.01	2.22	0.98	1.95	0.70
interest	2.49	0.96	2.30	0.61	0.72	.00	2.60	0.86	2.42	0.69	0.13	.01	2.56	0.98	2.25	0.63
joy	2.23	0.85	2.52	0.57	2.78**	.04	2.39	0.92	2.50	0.64	2.03*	.02	2.13	0.91	2.23	0.52
love	2.16	1.16	2.27	0.89	1.56	.01	2.19	1.25	2.24	0.99	1.12	.01	1.83	1.19	1.91	0.86
pride	1.21	1.06	1.47	0.82	1.45	.01	1.25	1.15	1.45	0.81	1.10	.01	1.04	0.95	1.23	0.73

Note. ANCOVAs are comparing each emotion between the intervention condition and the placebo control condition while controlling for the pretest scores.

*p < .05; **p < .01; ***p < .001 (two-tailed).

Distinct Emotions

Additionally, we analyzed whether the conditions differed with regard to distinct positive emotions (means, standard deviations, and comparisons among the conditions are given in online supplementary Table 2). ANCOVAs (predicting each positive emotion during the intervention week by condition [0 = PCC, 1 = 3GT, 2 = 3FT] while controlling for the baseline) suggested that the conditions differed in amusement (F[2, 177] = 3.26, p = .041, η^2_p = .04), contentment (F[2, 177] = 5.53, p = .005, η^2_p = .06), hope (F[2, 177] = 3.52, p = .032, η^2_p = .04), and joy (F[2, 177] = 4.07, p = .019, η^2_p = .04; all two-tailed tests). Post-hoc tests revealed that both PPIs scored higher than the PCC in all these positive emotions, with the exception of amusement that was only elicited in the 3FT.

Emotion word use

We compared the content of the participants' notes among the conditions. For this purpose, we used the *Linguistic Inquiry and Word Count* (LIWC; Pennebaker, Booth, & Francis, 2007; German dictionary by Wolf et al., 2008) tool and compared the relative frequency of words relating to positive emotions (e.g., love, nice) and negative emotions (e.g., ugly, hurt) among the conditions. Results showed that the PPIs used more positive emotion words (F[1, 178] = 63.50, p < .001, η^2_p = .26), and less negative emotion words (F[1, 178] = 10.20, p = .002, η^2_p = .05; one-tailed tests) than the PCC. These effects were observable in both PPIs.

Findings remained unchanged when controlling for the length of participants' notes, although those in 3GT wrote less than those in 3FT (t[125] = 2.65, p = .009). Further, emotional word use was unrelated to emotions, or well-being. The best predictor from the linguistic analyses, was the word count (positive emotions intensity: r = .17, p = .024; variety: r = .05, p = .481; well-being: r = .19, p = .009).

Do changes in distinct emotions predict well-being?

We examined whether those positive emotions elicited by the interventions (i.e., amusement, contentment, hope, and joy) could explain the increases in well-being. We computed a set of mediation analyses predicting well-being with the same specifications (0 = PCC; 1 = each PPI separately), with each distinct positive emotion (residualized change scores) as a mediator, while controlling for the baseline levels of well-being. Results suggested that in the 3FT amusement, contentment, and joy were mediators, while in the 3GT only contentment and joy were involved.

Additional References

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